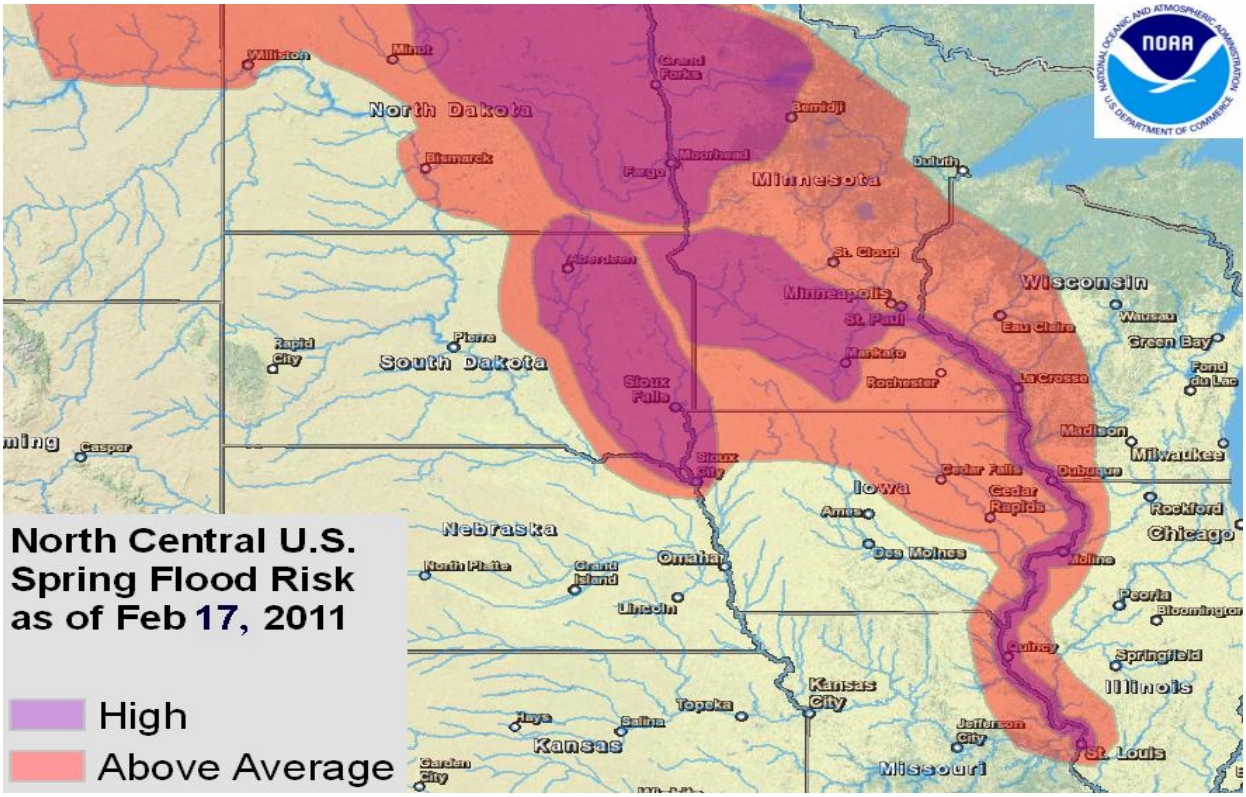
North Central United States Spring Flood Risk



(February 17, 2011)*This initial release of the Hydrologic Assessment only focuses on the North Central U.S. and will be updated on February 24. The final 2011 assessment to be issued March 17th will include a hydrologic assessment for the entire United States.*

General Assessment

An above average risk of spring flooding exists across a large portion of the North Central United States including North and South Dakota, Montana, Minnesota, Wisconsin, and Iowa. Heavy autumn rains and above average water content in the snow pack throughout the North Central U.S. have produced a high risk of moderate and major flooding for the Spring of 2011. Areas of greatest concern include the Red River of the North in North Dakota and Minnesota, Devils Lake in North Dakota, the James River and Big Sioux River in South Dakota, and areas along the Upper Mississippi River including Minnesota, Wisconsin, Iowa, Illinois and Missouri.

This product is designed to assess the primary conditions at the end of winter which increase the potential for flooding during the coming spring. The risk of flooding is gauged by the cumulative impacts of precipitation, groundwater conditions, stream flow, snow conditions, river ice and reservoir storage. Heavy rainfall at any time can lead to river flooding, even when overall river flood potential is considered below average. Ice jams can cause rapid water level rises on rivers with significant ice accumulation. The extent of flood risk also depends on the rate of melt (how quickly temperatures warm).

Current hydrologic conditions in the North Central U.S. called for an early issuance of the hydrologic

assessment focusing on this area. This assessment will be updated on February 24. The final 2011 hydrologic assessment will be issued March 17 and will include a hydrologic assessment for the entire United States.

Hydrologic Conditions in the North Central U.S.

- Heavy autumn rains left saturated soils across much of the North Central US; saturated soils have little if any capacity to retain melting snow.
- More snow and higher water content in snowpack than previous few years.
- Red River of the North flows from south to north and the extremely flat terrain of eastern North Dakota and northwest Minnesota (less than 1 foot drop in 1 mile) will allow water to build up across the countryside for the remaining winter and spring.
- Very high potential for widespread major flooding in Minnesota, North Dakota, and South Dakota
- Any above normal winter/spring precipitation will elevate this flood risk.

Heavy late summer and autumn precipitation (twice the normal amount since October in parts of North Dakota and Minnesota) have soils saturated and streams running high before the winter freeze-up. Another winter of above average snowfall has added water to the snow pack on top of the frozen saturated soils in the North Central US. NWS models show this snowpack containing a water content ranked in the 90 to 100 percentile when compared to a 60 year average.

These factors have combined to create some of the highest soil moisture contents of the last century. NWS one-month climate forecasts show chances favor a colder than normal last month of winter across the entire North Central U.S., while precipitation patterns appear to be near normal.

Areas of Above Average and High Risk (click for detailed view of river flood forecasts)

Red River Basin:
Fall precipitation was 150 to 300 percent of normal across the entire basin. Precipitation in December and January has been above normal throughout much of the basin, as much as 400 percent in parts of North Dakota and more than 200 percent in most of the rest of the basin. Current modeled snow water equivalents average 4 to 5 inches in the North Dakota tributaries and the main stem Red River. Already the Southern Red River Basin has a higher risk of spring flooding compared to the 2006 or 2009 major flood events. Fargo, N.D., has about a 95 percent chance of exceeding major flood stage of 30 feet where portions of downtown Fargo begin flooding and temporary dike construction is necessary; and a 15-20 percent chance of reaching or exceeding the 40.84-foot record set in 2009. Grand Forks, N.D., has a greater than 95 percent chance of exceeding major flood stage of 46 feet and near a 10 percent chance of exceeding the 54.35-foot record set in 1997.

Devils Lake Basin:

Fall and winter conditions are nearly identical to the Red River Basin. Devil's Lake is forecast to exceed 1454 ft this spring. Devils Lake and Stump Lake reached a new record height of 1452.1 ft late this past summer. They have now frozen over at their highest levels ever recorded. There is approximately a 33% probability of exceeding 1455 ft. At 1455 ft, impacts could include partial inundation of: *portions of the*

town of Minnewauken, ND, including critical infrastructure and roads across the lake, emergency service routes and possibly a small section of the Amtrak line.

Minnesota River and Upper Mississippi River (click for detailed view of river flood forecasts)

There is a greater than 50% risk of major flooding in Minnesota from the Twin Cities to the Minnesota/Wisconsin border.

Widespread record and near record rainfall occurred across the entire Minnesota River valley near the end of September. Winter precipitation through January exceeded 200 percent of normal across the entire Minnesota River basin. Combined with the wet antecedent conditions that were in place throughout the spring and summer of 2010, major to record flows were observed at many points following this event. The Upper Mississippi Basin in Minnesota has received roughly twice the normal precipitation during the last 3 to 4 months. Soil moisture values rank near 100% of the 60- year average. Current modeled snow water equivalents average between 3.5 and 5.5 inches across the area. The current average snow depth is generally around 18 inches above average across the entire upper basin, with snow water equivalents ranking among the wettest on record (over 90th percentile). St. Paul, Minnesota has about a 95 percent chance of exceeding major flood stage of 17 feet where secondary flood walls are deployed to protect St. Paul airport; and a 15 percent chance of exceeding the record 26.4 feet set in 1965.

Further downstream, the risk of major flooding on the Mississippi River through the Iowa, Illinois and Missouri borders will persist into the spring. Flood waters will take time to reach these areas, and much of the region's snowpack typically falls later in the winter. The quantity of spring rains and late-season snow will be a major factor down towards the Middle Mississippi Valley. More information on Central Mississippi Valley areas will be available during late February and March National Hydrologic Assessments.

Missouri River Basin

This region experienced similar hydrologic conditions as much of the Red River Basin through the fall and winter, with above average precipitation and stream flows. A greater than 50% risk of major flooding exists along the James River and Big Sioux Rivers in North and South Dakota into Iowa. The James River at Huron, SD, has about a 90 percent chance of exceeding major flood stage of 15 feet and a 30 percent chance of exceeding the record 21.28-foot level set in 1997. The Big Sioux River at Brookings, SD, has a greater than 95% chance of exceeding the major flood stage of 12 ft and a 30% chance of exceeding the 14.77 record set in 1969.

There is potential for moderate flooding of the lower Milk River Basin in far Northeastern Montana. A snowpack roughly 20 inches above average for this time of year, coupled with above normal soil moisture conditions is likely to raise the Milk above flood stage during the next few months. Some minor ice jam flooding is already occurring in Montana, additional flooding resulting from ice jams is likely throughout the late winter and early spring.

Summary

Fall precipitation was higher than normal across much of North Dakota, Minnesota and eastern South Dakota resulting in wet soils and high river base flows that are much above normal for this time of year.

Snow water equivalent estimates are higher over a larger portion of the North Central U.S. this year when compared to three of the most recent wettest years: 2006, 2009, and 2010. The areal extent and water content of the 2011 snow pack is much above normal with basin averages in the 90th percentile for a 60+ year period of record.

Major flooding is expected on all forecast locations on the Red River of the North and at many forecast locations on its Minnesota and North Dakota tributaries.

Moderate to major flooding is expected on the upper Mississippi River from the headwaters to Winfield, Missouri, on the Minnesota River in southeast Minnesota, on the Souris River in northwestern ND and on the James, Vermillion and Big Sioux Rivers in eastern South Dakota.

The magnitude of flooding will be determined by the amount of snow yet to fall and the weather conditions during the melt. Spring temperatures will determine the rate of snow melt and the effects of ice jams, which can both greatly alter the level of risk. Any spring precipitation will swell rivers and streams that should be near or above capacity during that time.

Information specific to the Red River of the North and Devil's Lake:

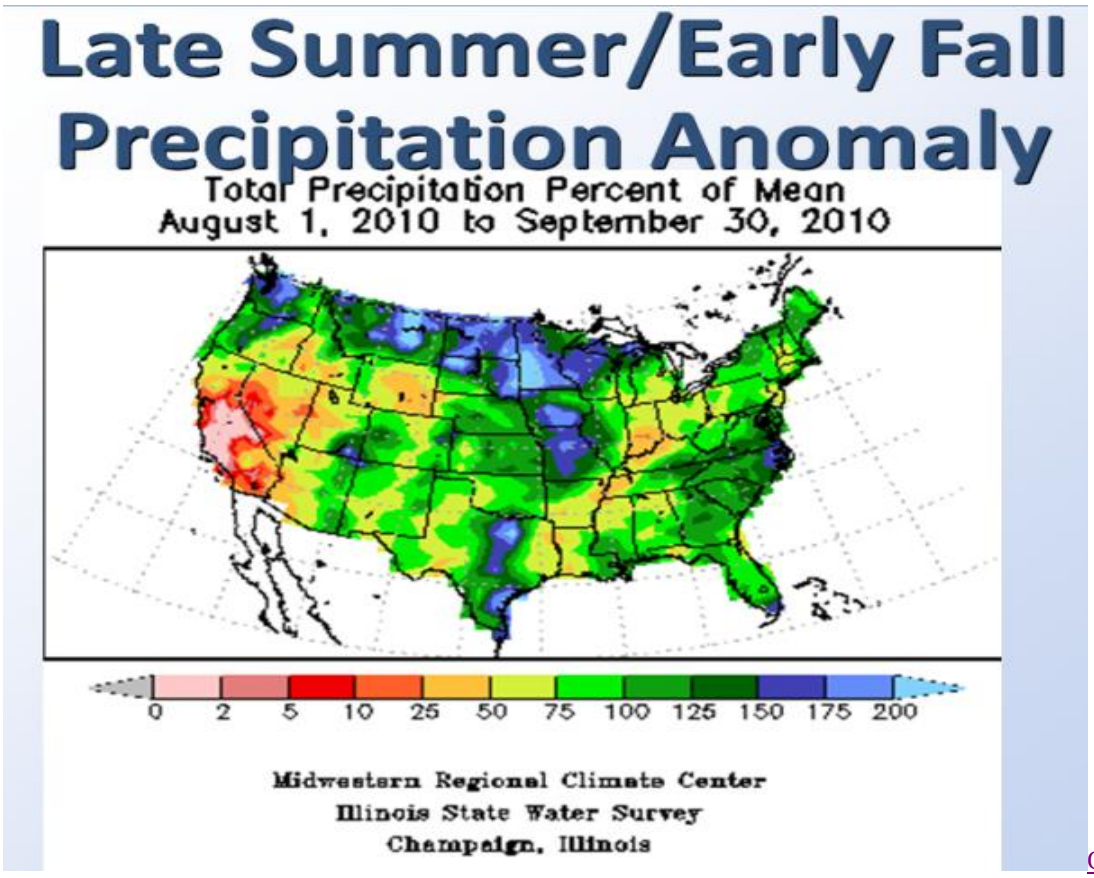
http://www.devilslake.noaa.gov/

Red River 2011 Floods Q&A

For current flood information:

http://water.weather.gov/ahps/

Roham Abtahi
National Weather Service
Hydrologic Information Center



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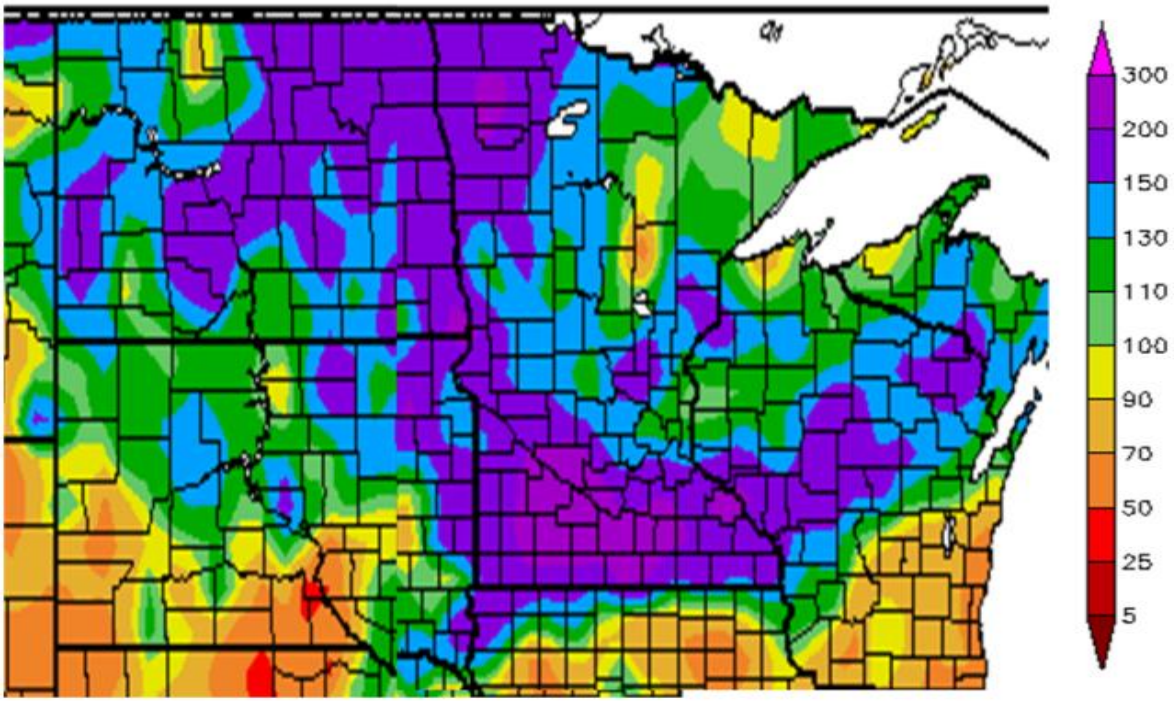
Percent of Normal Precipitation
09/01/2010 – 11/30/2010



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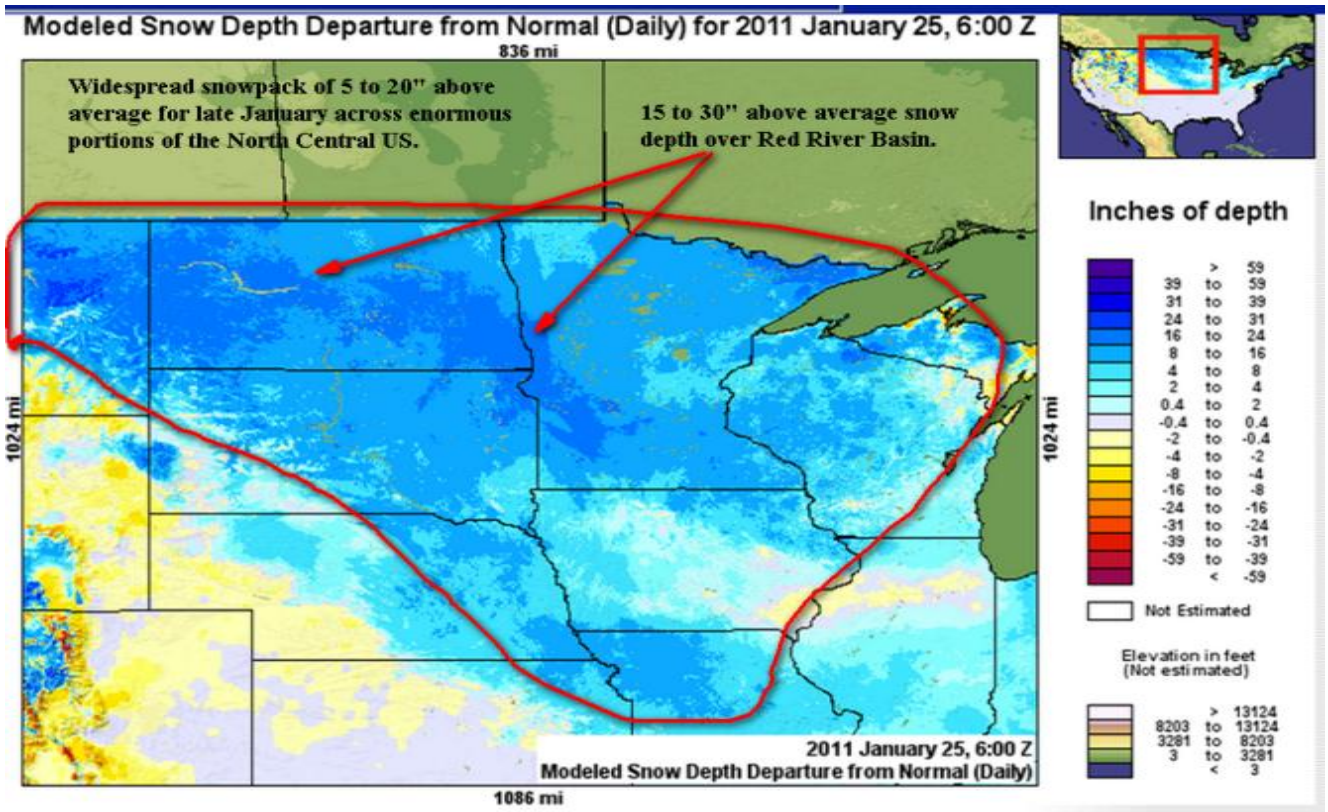

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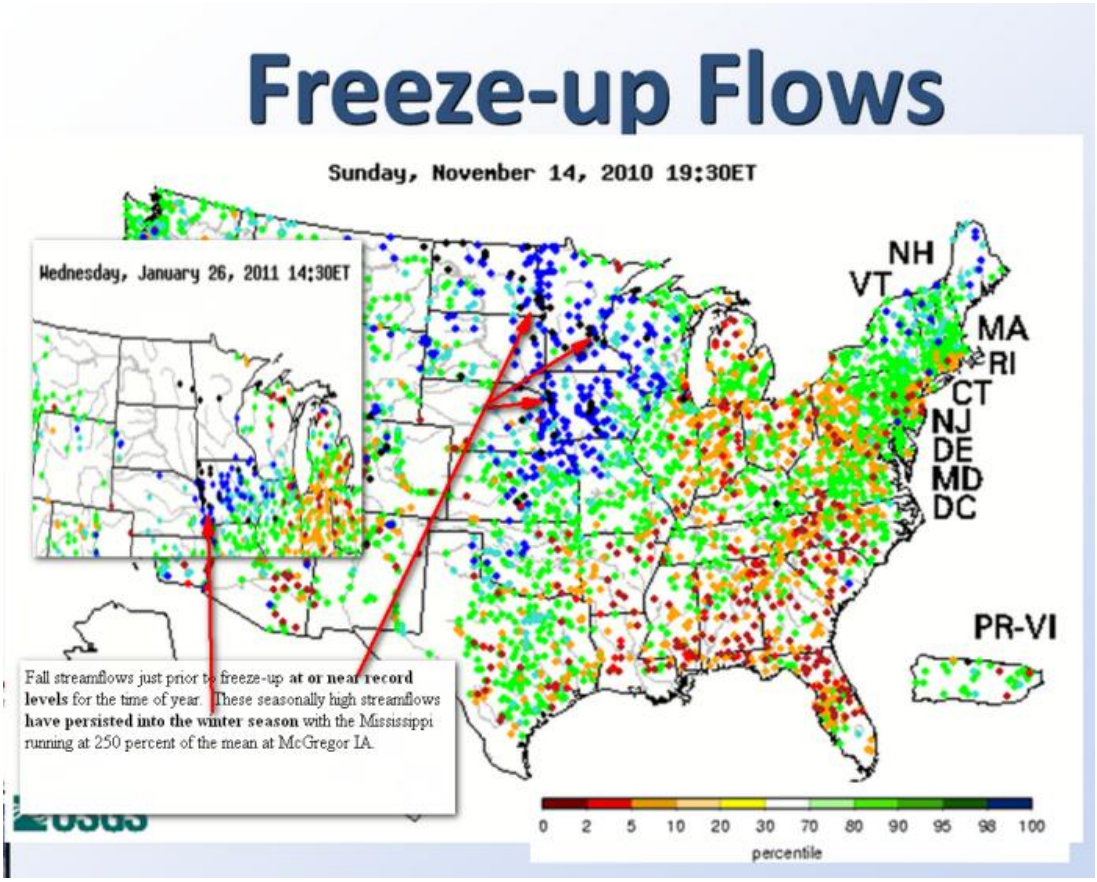

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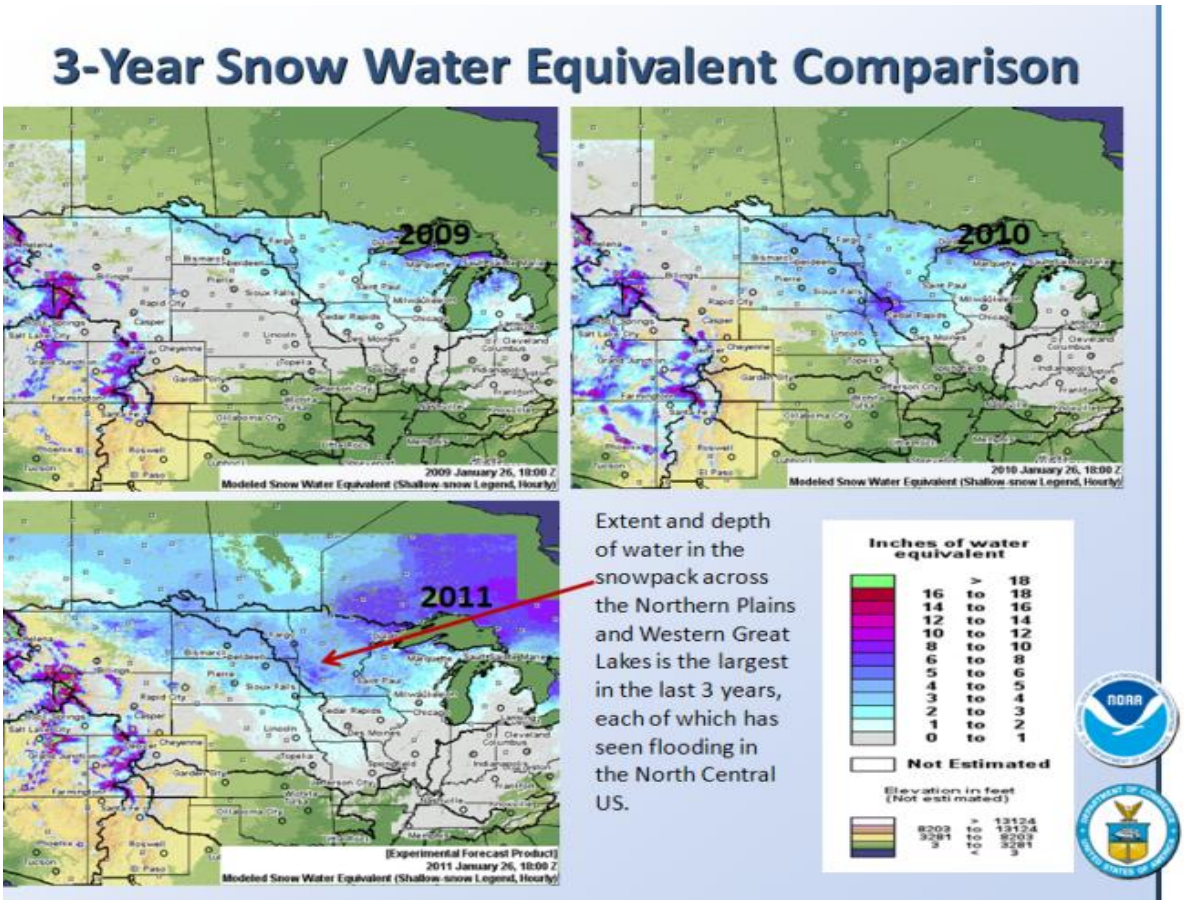

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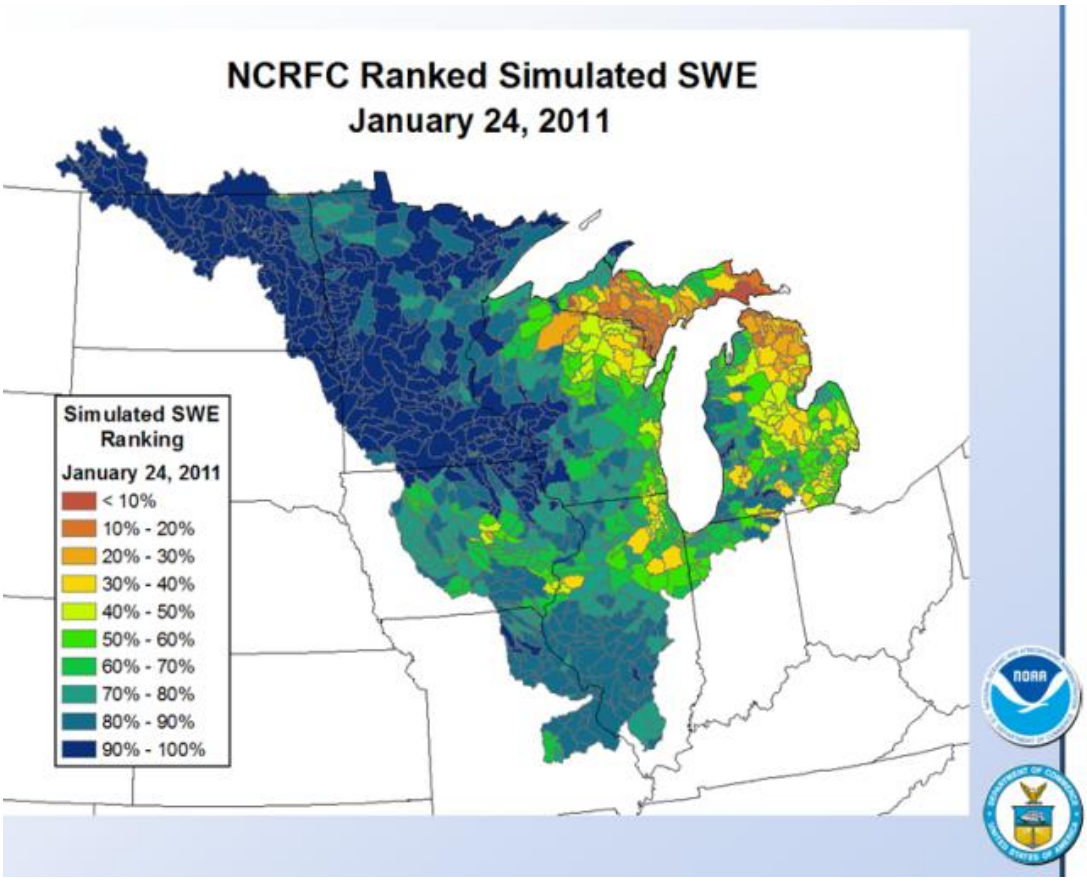

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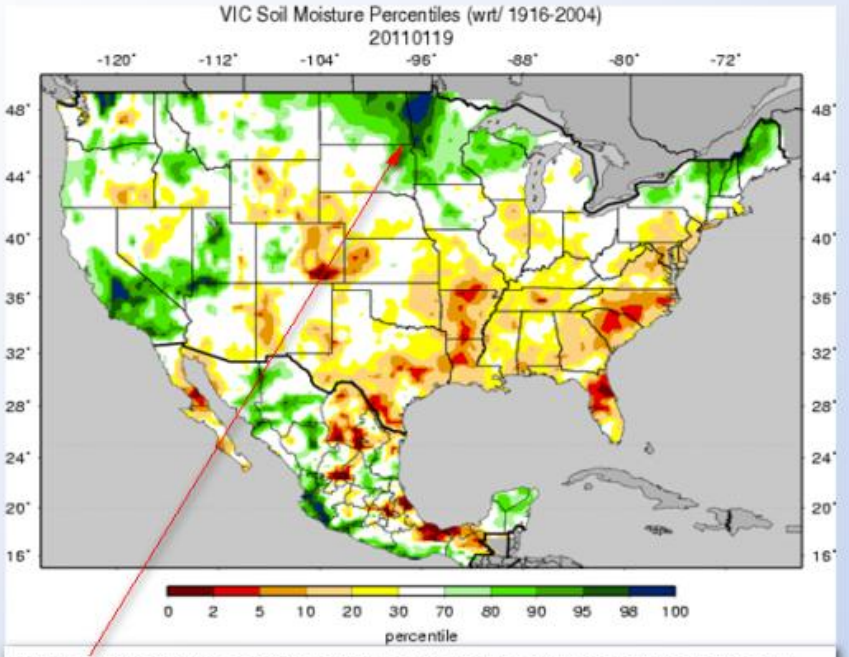
Soil Moisture Ranking



Soil moisture ranking as of Jan 2011, compared to an 88 year period of record. Wet soil moisture levels are indicated by green and blue colors The Red River of the North basin has some of the wettest soil conditions for this time.

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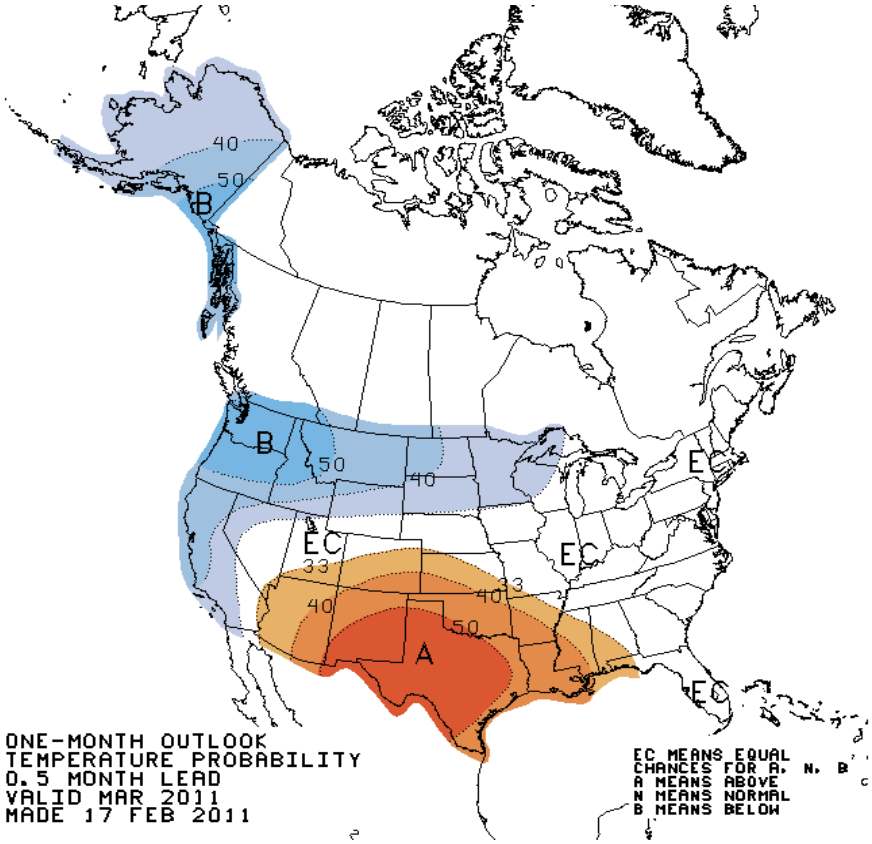

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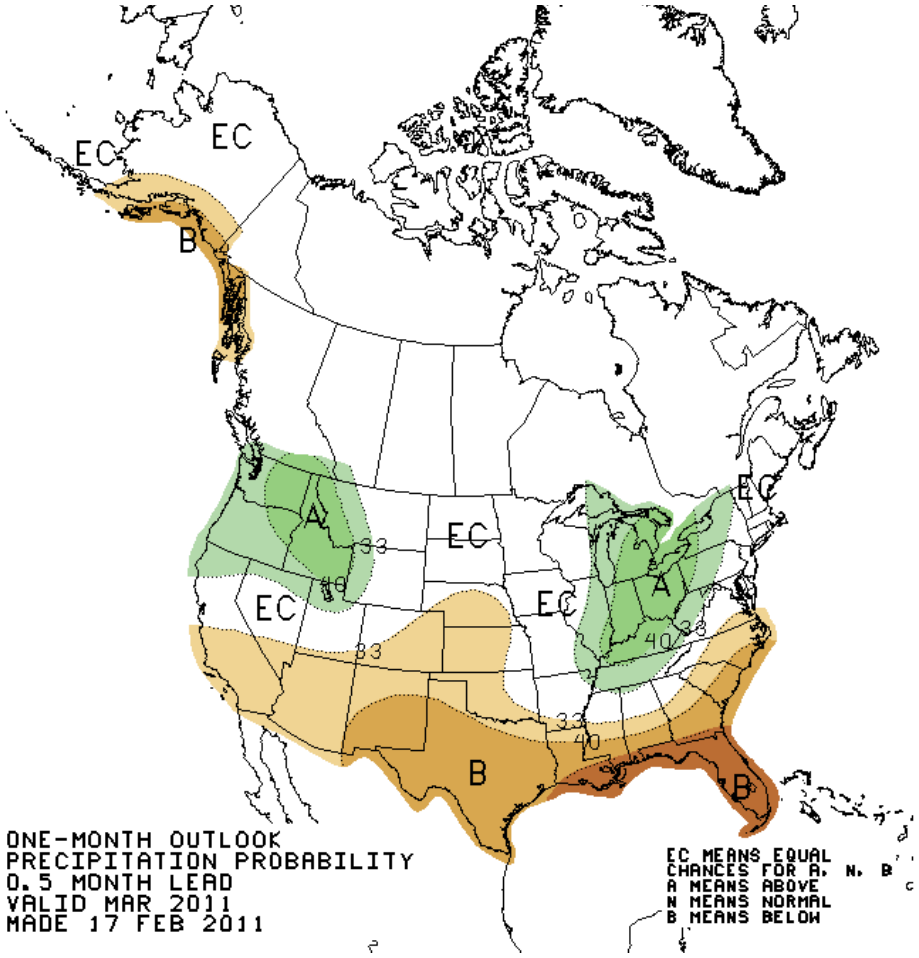

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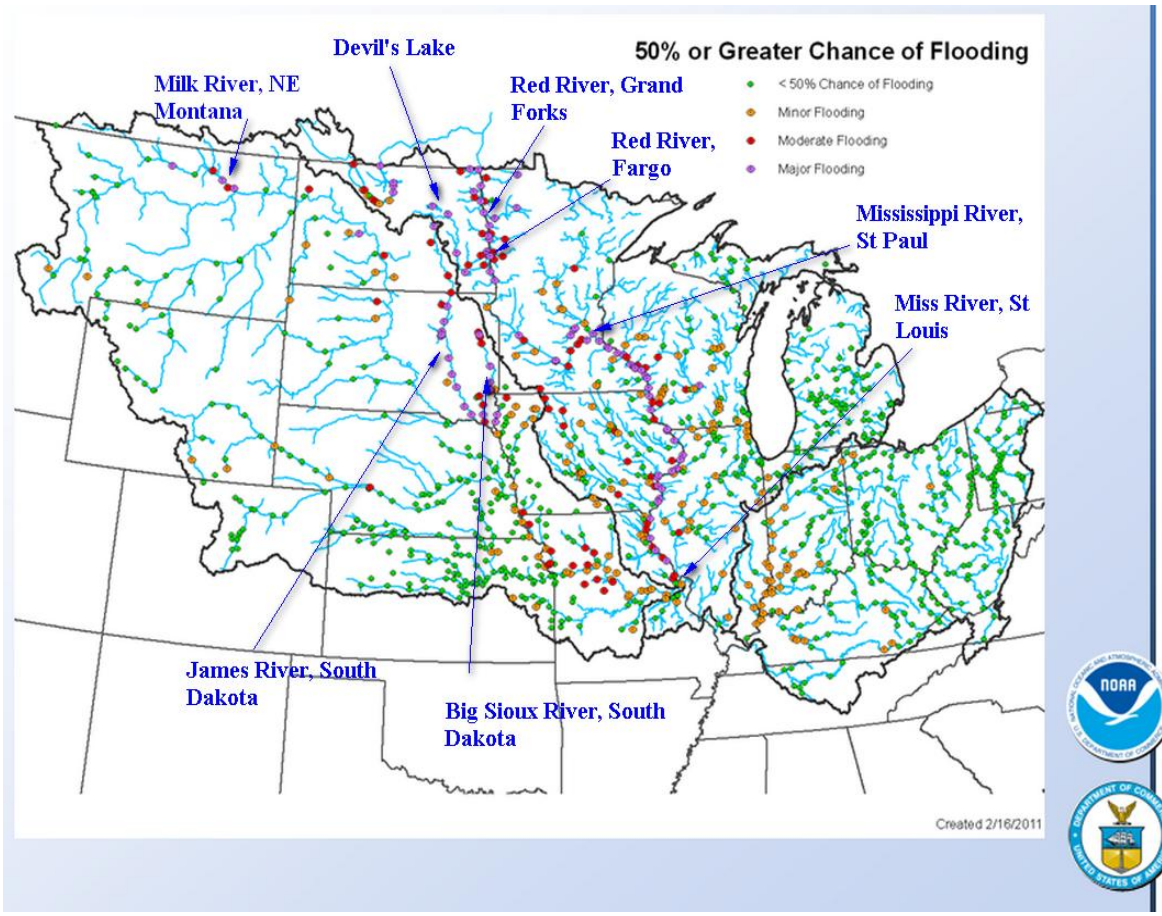

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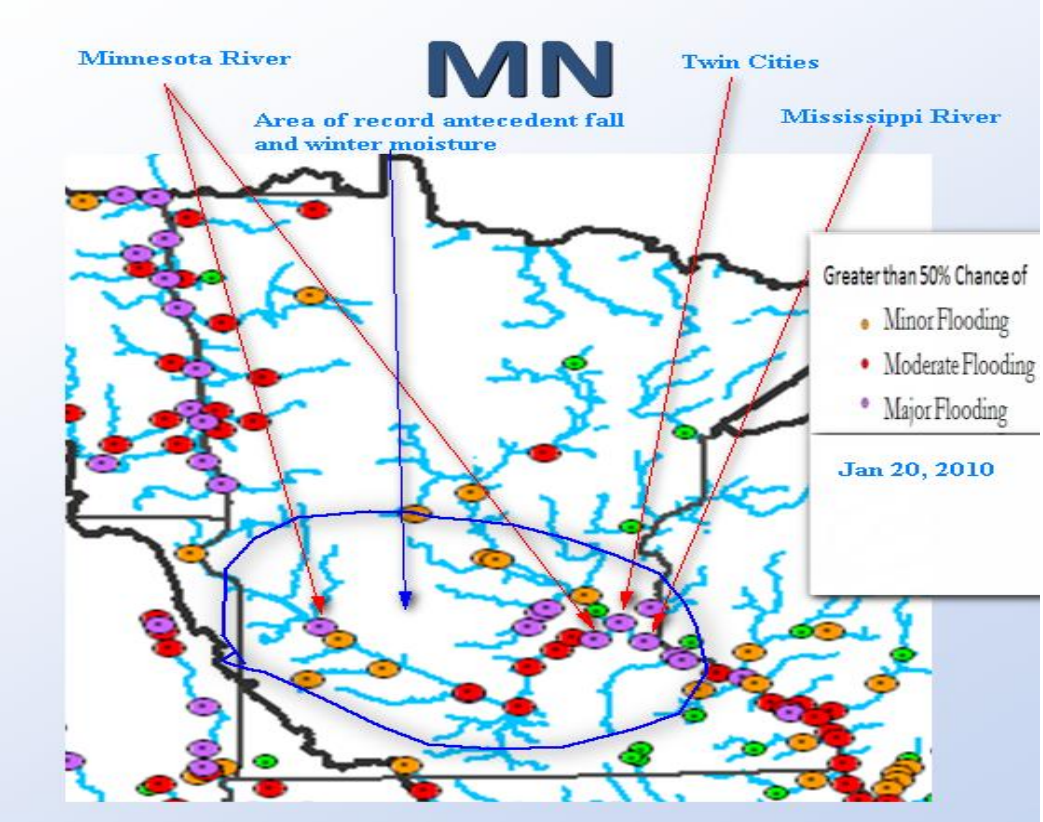

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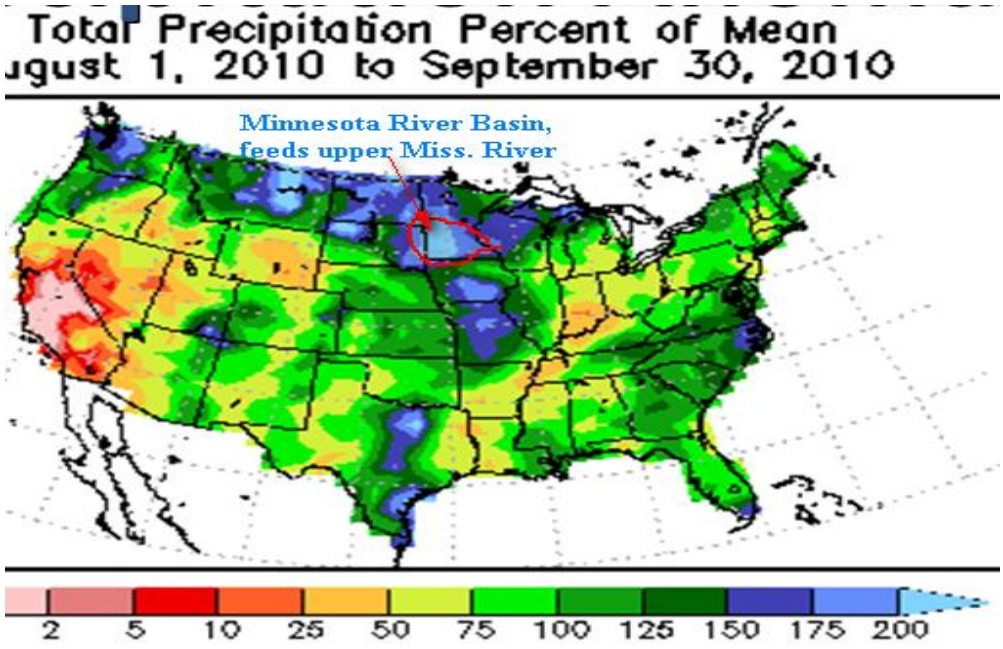

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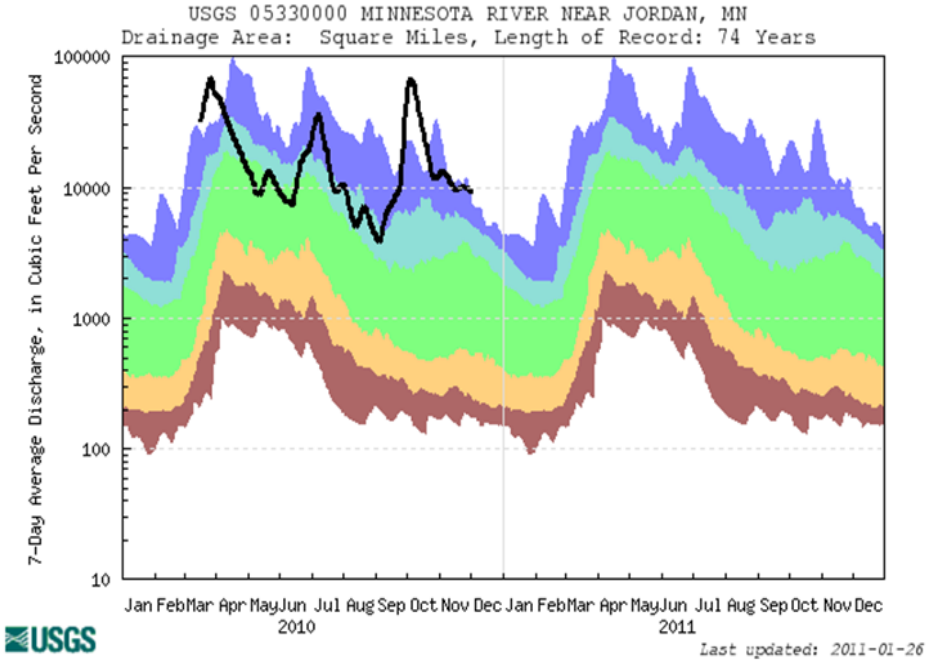
Minnesota River



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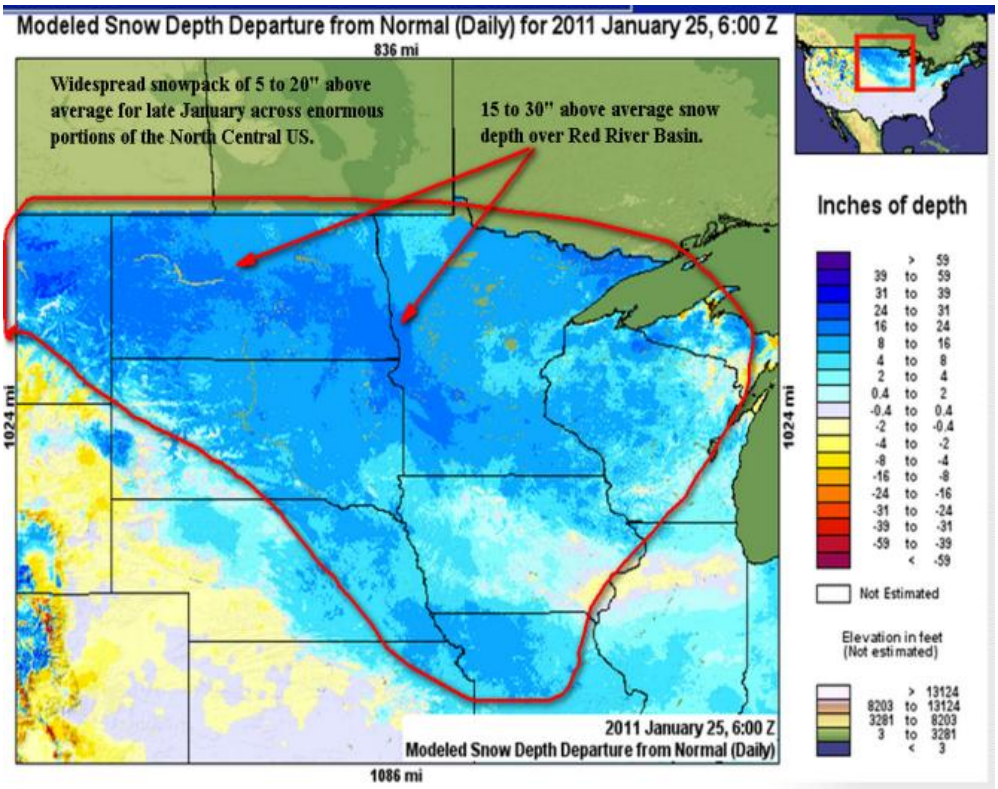

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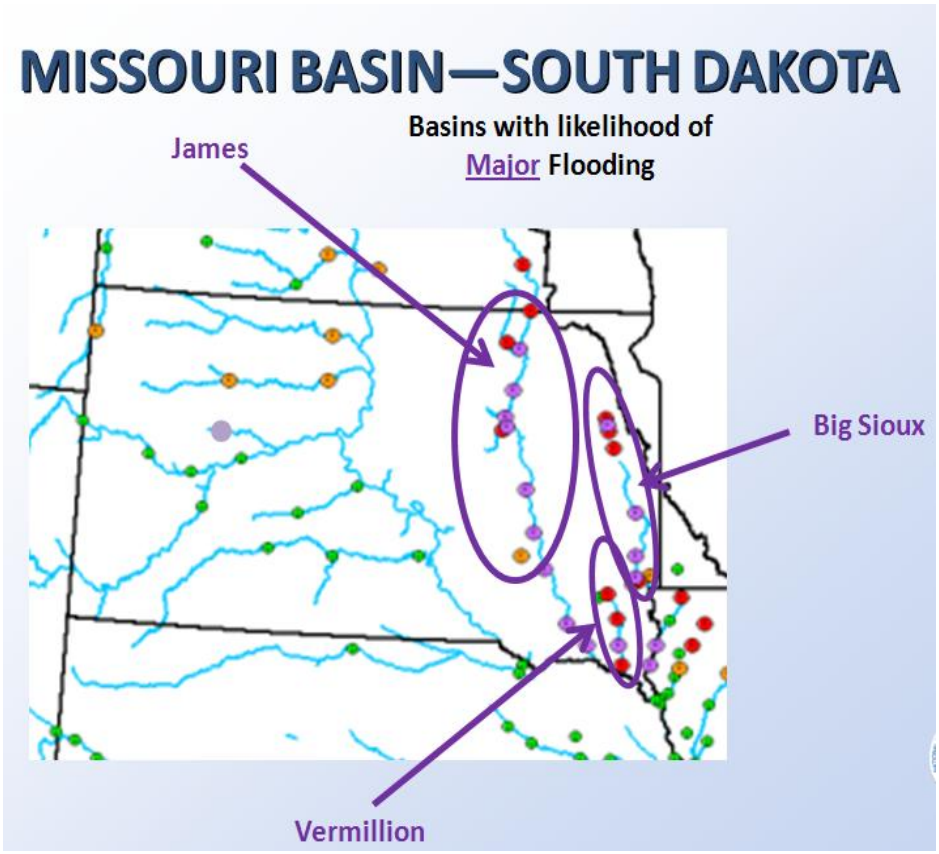

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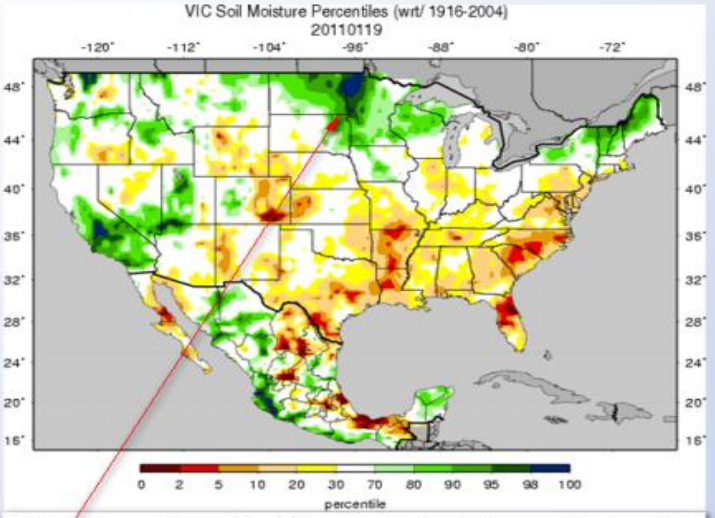
Soil Moisture Ranking



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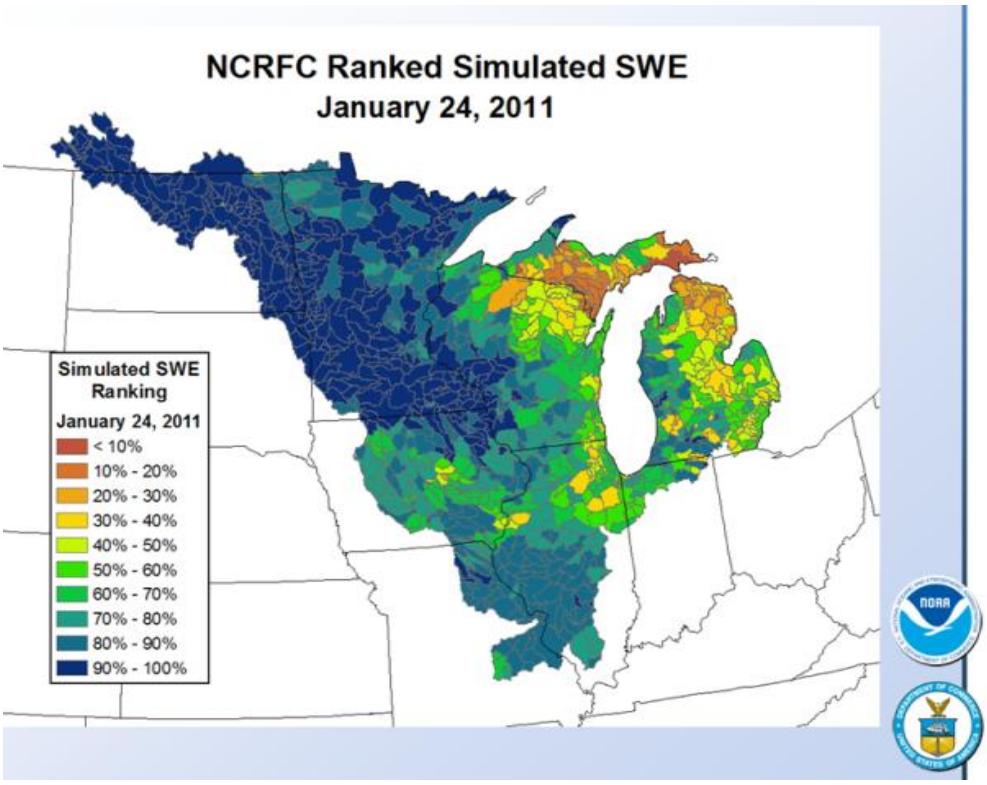

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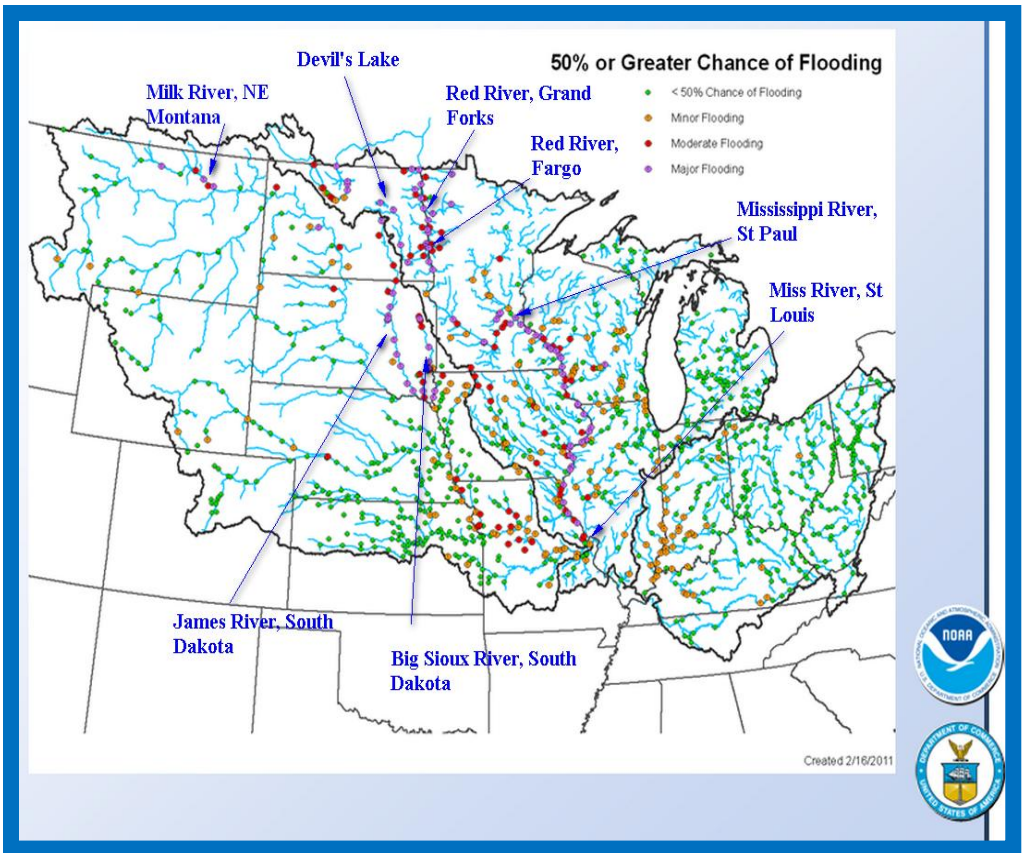

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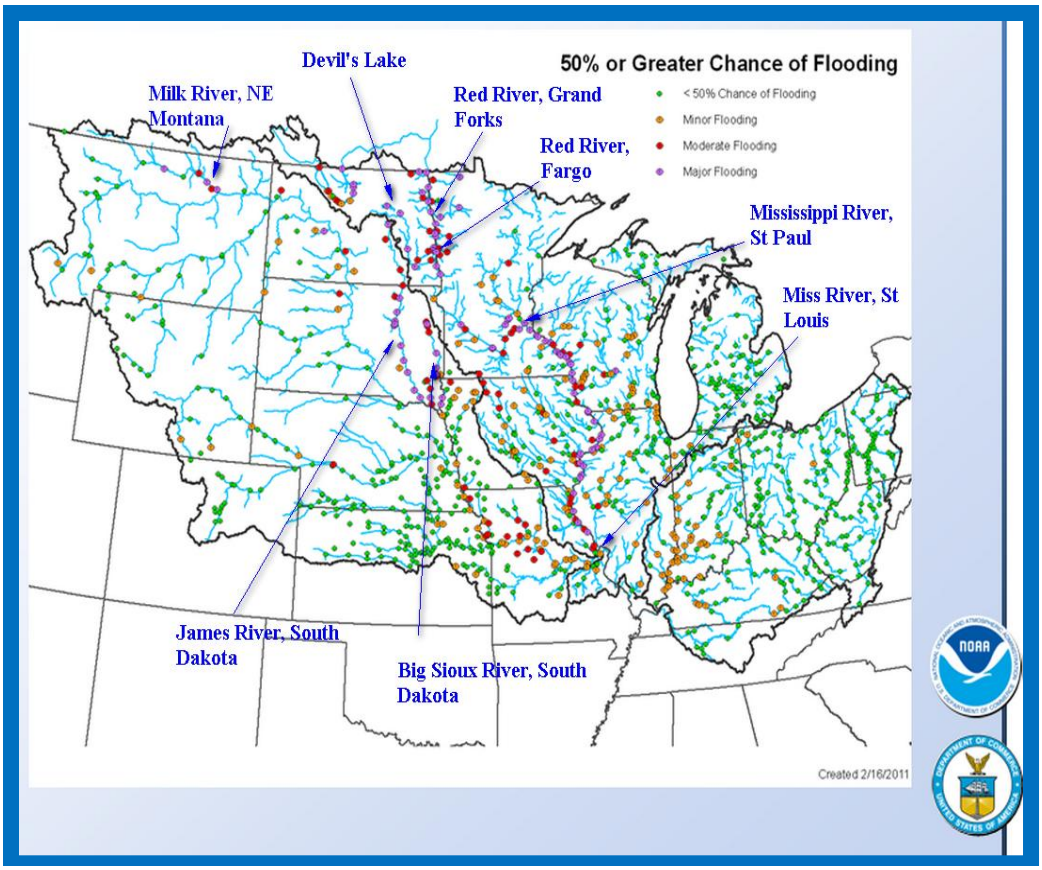

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February 17, 2011

RED RIVER OF THE NORTH 2011 FLOOD Q&A

Q. There has been major to record flooding on the Red River of the North for three years in a row; is that because of global warming/climate change?

- An assessment of the possible causes of the wet cycle that has been ongoing in the **Devils Lake, ND** area was completed last year.
  - (Ref. NOAA climate assessment at http://www.devilslake.noaa.gov/assessments/NOAA_Climate_Assessment_DevilsLake_July2010.pdf).
- The report was vetted through the USGS in Bismarck, North Dakota State Climatologist and internally in NOAA.
- Several lines of evidence lead to an assessment that the current wet epoch in the Devils Lake region is mostly part of a natural cycle of hydro-climate variability.
- The characteristic time history of this pattern is one of roughly decade-long variations, and appears not to be symptomatic of a fundamental change in the region's rainfall due to greenhouse gas effects.
- The recent extreme wet conditions thus are likely transitory in nature.
- No formal detection study has been undertaken to address whether a human-induced change in precipitation has occurred. It is noted, however, that most of the increase in annual rainfall since 1980 has resulted from heavy downpours, a feature that may be indirectly related to human activities.
- Another more broad assessment will be undertaken for the Red River Basin and completed over the next two months. While expectations as for the cause and longevity of the current wet episode are not expected to be vastly different than found in the Devils Lake area alone some important difference may be realized. It is too early to tell at the moment.

Q. Who is involved in the assessment and how is data being collected?

A. The Earth System Research Laboratory, Climate Prediction Center, National Weather Service Climate Services and the National Climatic Data Center are collaborators.

Q. Aside from examination of climate change or variability impacts, what is causing the expected flooding on the Red River this spring?

A. The Red River of the North watershed has been in a long term wet cycle since 1990, a period that includes the wettest 20-year average over Devils Lake since at least 1895 (ref. NOAA climate assessment at http://www.devilslake.noaa.gov/assessments/NOAA_Climate_Assessment_DevilsLake_July2010.pdf). Annual precipitation has been well above average most years in that

period. NOAA's National Weather Service has identified several other factors that have caused the major and near record flooding:

- Heavy autumn rains have saturated soils and kept the basin wet into winter
- Saturated soils have little if any capacity to retain melting snow
- Runoff into the river system has been greater due to heavy, above normal, snowpack combined with rapid thaw cycles
- The Red's northward flow into colder latitudes often leads to ice dams and ice jams
- Extremely flat terrain of eastern North Dakota and northwest Minnesota (less than 1 foot drop in 1 mile) slows the runoff process allowing water to build up across the countryside
- Frozen drainage structures in pastures and farm ground prevent early runoff from reaching tributaries that feed the Red and other major rivers

NOAA and NWS Contacts for Red River climate concerns are:
Doug Kluck, NOAA's Central Region Climate Services Director; 816-994-3008 or 816-564-2417
Fiona Horsfall, Chief, NWS Climate Services Division; 301-713-1970, ext. 182
John Eise, NWS Central Region Climate Services Program Manager, 816-268-3144